

FILTER TESTS ON SHARE PRICES¹

By J.A. Nolan, B.Ec. (Hons), M.A.,
Assistant Senior Economist, State Electricity Commission of Victoria.

M. Naphtali, B.Ec. (Hons), M.B.A.,
Corporate Services Advisor, Hill Samuel Australia Ltd.

P. Praetz, F.I.A.,
Associate Professor Economics and Politics, Monash University.

This paper discusses and tests the relevance of the theory of efficient capital markets on Australian Stock Exchange share prices using a financial type filter procedure. The theory simply states that a market in which prices fully reflect all available information is regarded as efficient.

Work by Praetz² on the statistical analysis of Australian share prices has revealed a lot more imperfections than have been observed in similar overseas studies. This paper seeks to test the efficiency of the Australian Stock Markets using a "financial" type test on Australian shares over a nine year period, including a wide range of filter sizes, adding transactions costs and avoiding the pitfalls that have invalidated some similar work overseas.

Fama³ (who helped formulate efficient market theory) has classified tests of that theory as weak, semi-strong or strong form tests if past prices, publically available information or inside information is respectively used. Thus filter tests are a weak form test of market efficiency.

Filter tests provide us with a mechanical financial test procedure to seek out imperfections in share prices as an alternative to statistical measures which have not found any appreciable imperfections. They provide us with an investment strategy whose performance can be measured in annual rates of return terms. We then compare these returns with those generated by the simplest form of investment strategy, the buy-and-hold investment rule. In general we do not find any evidence which would lead us to reject the efficient market theory as applied to Australian share prices.

Filter Tests and the Efficient Market Theory:

The efficient market theory postulates that the stock market provides a practical example of the giant of micro-economic theory, the perfectly competitive market. There are many buyers and sellers, all attempting to maximise their profits, a homogenous product, near perfect mobility. So, provided a sufficiently large number of investors are able to take account of all the knowledge available in the market, assumed costlessly available to all, no trading rule which will consistently yield abnormally high returns can be constructed.

The efficient markets theory is diametrically opposed to the claims of chartists, stock brokers, security analysts and others who claim that their researches provide knowledge which, if used in trading, will enable investors to earn excess profits from the purchase and sale of particular shares. In order to choose between these competing theories, a number of empirical tests have been devised of which filter tests are just one.

In order to approximate the trading rules devised by chartists, Alexander⁴ devised the filter test. A filter trading rule is used to "filter out" unimpor-

tant movements in the price of a share and to identify the significant movements. Thus, using an "x" percent filter, if a share price rises by X percent from a previous low, buy that share. If subsequently the share falls by X percent from a previous high, sell that share and simultaneously go short in it until the next X percent rise. This necessarily assumes that movements persist sufficiently to enable excess profits to be made. If the market is efficient however, this trading rule will not provide a higher return than simply buying and holding throughout any period. In essence, then, it is an attempt to discover whether there is any information conveyed by share prices which can be used to construct a particular trading rule which will guarantee a higher return than the naive buy-and-hold policy. If the rule is successful, the market is clearly not efficient — there is available unused information which can be utilized profitably.

The Test Procedure:

Table 1 presents the results of applying filter tests to ten Melbourne shares over 1958-66 using weekly prices with and without transaction costs. Annual average percent rates are given for the filters (RF — long and short positions) and a Buy and Hold

strategy (RBH) for each stock. Rates are averaged over 24 filters to 25% (as larger filters give erratic results) to summarize the 2320 individual rates. The price data is weekly (Wednesday) closing prices, adjusted for all capital changes assuming the immediate reinvestment of all dividends, from the Melbourne Stock Exchange. Short selling was not permitted in Melbourne then, but has been included for comparison with overseas studies and as it was permitted on the Sydney Exchange, where prices

are almost identical. The 29 filter sizes used were (%): $\frac{1}{2}$, 1, $1\frac{1}{2}$, 2, $2\frac{1}{2}$, 3, $3\frac{1}{2}$, 4, $4\frac{1}{2}$, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 20, 25, 30, 35, 40, 45, 50.

When the returns of the individual filters (RF) are compared with the returns from the buy-and-hold strategy (RBH), in only 27 (9.7%) of the 277 cases when filters operated is RF greater than RBH. When transactions costs are included, the percent falls to 3.5% (10 in 277).

TABLE 1: Annual Average Percent Rates of Return for Filter (RF) and Buy and Hold (RBH), with and without transactions costs.

Average over 24 Filters	NO TRANSACTIONS COSTS		TRANSACTIONS COSTS INCLUDED	
	R.F. %	R.B.H. %	R.F. %	R.B.H. %
COMPANY				
A.W.A.	-10.3	10.6	-27.9	10.1
A.C.I.	.1	13.1	-12.2	12.7
A.G.C.	-3.5	12.5	-20.8	11.9
BANK N.S.W.	3.8	10.9	-6.7	10.5
BR. TOBACCO	1.8	7.9	-12.6	7.5
B.H.P.	4.7	16.7	-7.1	16.2
C.I.G.	-1.7	9.2	-15.0	8.8
D.H.A.	-2.5	4.2	-16.7	3.8
I.C.I.	-.6	2.9	-14.3	2.5
MYER	-4.5	11.3	-20.1	10.8
AVERAGE OVER COMPANIES	-1.3	9.9	-15.3	9.5

TABLE 2: Annual Percent Rates of Return on Filters (RF) and Buy-and-Hold (RBH) for selected filter sizes, with and without transactions costs.

Average over 10 Shares	NO TRANSACTIONS COSTS		TRANSACTIONS COSTS INCLUDED	
	R.F.	R.B.H.	R.F.	R.B.H.
FILTER (%)				
1	-3.5	10.0	-39.5	9.6
2	-7.3	9.9	-34.7	9.5
3	-7.6	9.9	-29.6	9.5
4	-4.2	9.9	-22.0	9.5
5	-5.2	9.9	-20.1	9.5
8	-2.0	9.6	-11.4	9.2
10	1.3	9.6	-5.7	9.2
12	2.4	10.1	-3.1	9.6
15	4.2	10.4	0.0	9.9
20	4.8	10.7	1.9	10.1
AVERAGE OVER 24 FILTERS	-1.3	9.9	-15.3	9.5

In Table 1, averaging over filters, it is apparent that the RBH values are all positive, and range from 16.7% (B.H.P.) to 2.9% (I.C.I.). The filter returns, RF, range from 4.7% (B.H.P.) to -10.3% (A.W.A.). The returns from short selling are all negative, which reflects the substantial market rise over the nine year period; conversely, all the returns from being long are positive. When transactions costs are included in the returns, the RBH returns fall about half a percent, but the filter returns all fall heavily and are almost always negative. This is caused by the small filters which generate many transactions and so reduce the size of the returns substantially. For every share, average returns from buy-and-hold substantially exceed those from the filter rules.

In Table 2 we have presented returns for buy-and-hold and filter strategies for selected filter sizes averaged over the ten stocks, with and without transactions costs. For every filter size, it is apparent that buy-and-hold is far better than filters. RBH is fairly stable but RF increases approximately with filter size. When transactions costs are included, small filters do much worse because of the number of transactions involved.

Thus for all three comparisons, averaging over filters and over stocks and individually, it is clear that filters are not superior.

Conclusions

We have found no evidence to reject the efficient markets theory as there is no apparent tendency present for returns from the filter rule to systematically exceed returns from a buy-and-hold (do nothing) strategy. There does not seem to be any evidence for any particular filter size or individual share to generate abnormally high rates of return, relative to the "naive" buy-and-hold procedure.

The evidence presented in this study is of a very broad kind, in that we cannot observe any general tendency for excess returns to be produced, i.e. as a first approximation to describing the market mecha-

nism, the efficient market model is not contradicted.

The acceptance of the theory of efficient capital markets as a description of the Australian Stock Market has important implications relevant to participants in that market:

- (1) The findings of our study contradicts the claims made by chartists, that past price series can be used to predict the future behaviour of the series.
- (2) Those share brokers and investors who in their investment decision-making place some weight on 'technical' analysis including charting, should have a more critical look at the evidence for and against charting. Much of the onus here should lie with the research managers who produce the charts and recommendations for clients without having any evidence in support of the usefulness of charting as a profitable investment decision making tool.
- (3) Share brokers and other professional investment advisors, who either by the written or spoken word, make share investment recommendations to clients or employers regarding share trading should at the very least monitor the performance of their recommendations.

It is a lamentable reflection on the Australian Securities industry that it has not available, in any readily accessible form historical price data to evaluate historical investment recommendations of the industry. Given that many investors make decisions based on broker recommendations, we would maintain that the clients have a right to know the success of a particular brokers' past recommendations.

1. This article is based on "A Test of the Efficient Market Theory Using Filter Tests on Stock Prices", *The Economic Record*, Vol. 51, March 1975, by P. Praetz, M. Naphtali and J. Nolan.
2. Praetz, P.D., "Australian Share Prices and the Random Walk Hypothesis", *The Australian Journal of Statistics*, Vol. 11, No. 3, November 1969, pp. 123-139.
Praetz, P.D., "The Distribution of Share Price Changes", *Journal of Business*, Vol. 45, No. 1, January 1972, pp. 49-55.
Praetz, P.D., "A Spectral Analysis of Australian Share Prices", *Australian Economic Papers*, 12, 1973, pp. 70-78.
3. Fama, E.F., "Efficient Capital Markets: A Review of Theory and Empirical Work", *Journal of Finance*, Vol. 25, May 1970, pp. 383-423.
Fama, E.F. and Blume, M.E., "Filter Rules and Stock Market Trading", *Journal of Business*, Vol. 39, 1966, pp. 226-241.
4. Alexander, S.S., "Price Movements in Speculative Markets: Trends or Random Walks", *Industrial Management Review*, 2, May 1961, pp. 7-26.

Alexander, S.S., "Price Movements in Speculative Markets: Trends or Random Walks No. 2", *Industrial Management Review*, 5, Spring 1964, pp. 25-46.